RESEARCH
www.commprac.com
ISSN 1462 2815

SURVEY ON CAREGIVERS' BURDEN OF CARE PATIENTS WITH CHRONIC STROKE AND CONSIDERATIONS ON THE ROLE OF THE PHYSIOTHERAPIST

Roberto Materia [1], Alessandra Cuffaro [2], Rosario La Bruna [3],
Mariana Pastore [4], Vincenzo Ronsivalle [5],
Cesare D'Amico [6] and Luca Fiorillo [7]*

[1] Department of Physical and Rehabilitation Medicine, University of Messina,
Via Consolare Valeria, 1, Messina, Italy.
[2] Private Practice, Agrigento, Italy.
[3] Private Practice, Reggio di Calabria, Italy.
[4] Private Practice, Trieste, Italy.
[5] Department of General Surgery and Surgical Medical Specialties,
School of Dentistry, University of Catania, Catania, Italy.
[6,7] Department of Biomedical and Dental Sciences, Morphological and
Functional Images, University of Messina, Via Consolare Valeria, 1, Messina, Italy.
[7] Multidisciplinary Department of Medical-Surgical and Odontostomatological Specialties,
University of Campania "Luigi Vanvitelli," Naples, Italy.
[7] Department of Public Health Dentistry, Dr. D.Y. Patil Dental College and Hospital,
Dr. D.Y. Patil Vidyapeeth, Pune, India.
*Corresponding Author Email: lfiorillo@unime.it

DOI: 10.5281/zenodo.12165472

Abstract

Introduction: Stroke is a leading cause of disability and poses significant challenges not only to patients but also to their caregivers, who often experience considerable psycho-physical burdens. The role of caregivers in the rehabilitation process is crucial, yet the impact of caregiving on their well-being is not fully understood. This study aims to analyze the psycho-physical load on caregivers of chronic stroke patients, evaluate the variables affecting their health, and assess the significance of physiotherapists in improving patient rehabilitation outcomes. **Materials:** A sample of 30 chronic stroke patients and their caregivers involving home-based rehabilitation services was examined over an eight-week period. The study utilized various scales such as the Short Form Health Survey 36 (SF-36), Barthel Index, Stroke Impact Scale 3.0, Modified Rankin Scale, and Caregiver Burden Inventory to assess the health status of patients and the burden on caregivers before and after the intervention. **Results:** The study found significant improvements in patient health metrics (SF-36, Barthel Index, Stroke Impact Scale, Modified Rankin Scale) post-rehabilitation. Similarly, a notable reduction in caregiver burden was observed, highlighting the effectiveness of targeted physiotherapy interventions in alleviating the psycho-physical stress on caregivers. **Conclusion:** Physiotherapists play a critical role in stroke rehabilitation, reducing caregiver burden. Early identification of exhaustion, timely physiotherapy, and multidisciplinary rehabilitation can improve patient independence and quality of life for both patients and caregivers.

Keywords: Caregivers; Stroke; Chronic Disease; Physiotherapist; Burden.

1. INTRODUCTION

In Italy, stroke is the third leading cause of death, represents the leading cause of disability and is the second leading cause of dementia [1]. It is shown that within one year after the acute event, 1/3 of ischemic or hemorrhagic stroke survivors have a high degree of disability [2]. After the hospital period, in which the patient is cared for in the emergency and acute phases, the patient's post-acute care pathway continues with an integrated post-hospital and home care process [3]. The World Health Organization defined Home care as an array of health and social support services provided to clients in their own residence. Such co-ordinated services may prevent, delay or be a substitute for temporary or long-term institutional care. Home care is a crucial aspect of the recovery process as it improves the patient's morale and wellbeing by involving them in decision making in their own home. Thus, it maximizes the patient's independence. It reduces hospital admission days thereby reducing cost of care and with an earlier discharge, more patients can be treated in the same number of beds.[4,5] With a total amount of €4 billion in investment, "Home as the First Place of Care: Home Care Assistance" has three primary objectives: improving the number of patients assisted in their homes to over a million and a half by 2026 (10% of >65 years old population); implementing a new organizational model by creating local operational hubs, to ensure the continuity, accessibility and integration of healthcare; and promoting and financing the development of new telemedicine projects for remote assistance by regional healthcare systems.

In the home care setting, the caregiver of stroke survivors is involved in in-home care and can actively collaborate in the rehabilitation process, which guides the patient to attain the motor skills necessary for performing activities of daily living.[6] The caregiver involvement in the rehabilitation process and proper knowledge of the most appropriate management strategies related to the patient's pathology can lead to favourable repercussions on functional recovery and the degree of disability.[7,8] The motor complications can occur following a stroke and they face reintegration of the patient into the home environment, guiding them in acquiring new motor strategies to achieve better autonomy. Additionally, during the rehabilitation process in the home setting, taking charge of the patient and caregiver, the physical therapist can help the process of functional recovery of the patient and improve the quality of life of the caregiver, as the rehabilitator can take care of providing the caregiver with adequate skills in knowledge of the characteristics of the pathology, suitable strategies for the management of the patient, education to cope with difficulties, and participation in the process of reintegrating the patient into daily life.

However, several studies have confirmed that caregivers experience psychophysical overload in terms of high anxiety, perceived stress, loneliness, reduced social activities and overall quality of life. There is also an increased risk of depression in caregivers of stroke patients after the stabilization of functional impairment, as caregivers often face difficulties such as a lack of support in the knowledge of the disease and a lack of skills in managing the paperwork necessary to provide care in the home environment.[9-11] A deflection of the caregiver's mood tone and the lack of appropriate tools to cope with the problems of the patient's reintegration into the home environment can result in negative implications by unfavourably influencing the rehabilitation process and social inclusion, increasing the patient's degree of disability.[12] A weak positive correlation was discovered between caregiver burden and patient's age, level of disability, socioeconomic status, and more excellent caregiving hours, particularly among female and male caregivers [13]. In an analysis that used caregiver reaction assessment (CRA) to evaluate burden, they highlighted that caregivers faced difficulties paying for the patient's health needs and services.[14] Others reported that they did not have the strength to care for the patient and were mainly tired from caring for their relative. The present study was conducted to determine fluctuation in the levels of stress influenced by variables such as the characteristics of the caregiver and the patient himself, and also to describe the role of the physiotherapist within this context and discuss reduction of the caregiver's care load through his intervention and the patient's autonomy improved, presented as the need of the study. In line with above observations, our study aimed to detect, describe and evaluate the caregiver burden perceived by caregivers in the home management of people with ictus.

2. MATERIALS AND METHODS

2.1 Sample

The study examined 30 chronic stroke patients and the same caregivers caring for them. The patients were recruited in the Agrigento area through the rehabilitation service offered by integrated home care (ADI), which is prescribed by the specialist or family doctor and provides the patient with health care at home. The project lasted eight weeks, with a cadence of 3 weekly accesses lasting 60 minutes. A total of 24 accesses were performed. With a margin of error of approximately 9% and a confidence interval of 95% on a population of 30 individuals the sample size is sufficient for the number of 24.

2.2 Inclusion and exclusion criteria

Participants had to meet the following criteria to be eligible for the conduct of the study: Stroke patients must be diagnosed as stroke by brain computed tomography or magnetic resonance imaging, they should have no cognitive or speech impairment. Caregivers must be 18 years of age or older, may or may not have consanguinity ties with the patient, and must comply with the execution of the guidelines issued by the physical therapist for the conduct of the study. Participants were excluded if: The patient resides in a long-term care institution or died during the study. The caregiver is not interested in participating in the study.

2.3 Procedure

The study conducted by the research team was split into two phases of data collection and intervention aimed at the patient and caregiver of the patient, respectively. According to the Council for International Organization of Medical Sciences (CIOMS-2016), approval by an ethical committee is not required because “the research poses no more than minimal risk to participants” with his non-invasive practice. The patients were selected among candidates already for rehabilitation; no personal data are shown, and this method could not have caused any damage.

2.4 Sample selection

2.4.1 The patient study consisted of taking a detailed medical history collection including age, gender, marital status, household number, education level, employment status, diagnosis of pathology (ischemic or hemorrhagic stroke), and the onset of pathology. A pre- and post-rehabilitation treatment assessment by administering the following rating scales: Short Form Health Survey 36 (SF- 36)[15], Barthel Index[16], Stroke Impact Scale 3.0[17], Modified Rankin Scale (MRS)[18]. Contextual factors were collected. Based on the data, a rehabilitation program was design and executed (Figure 1).

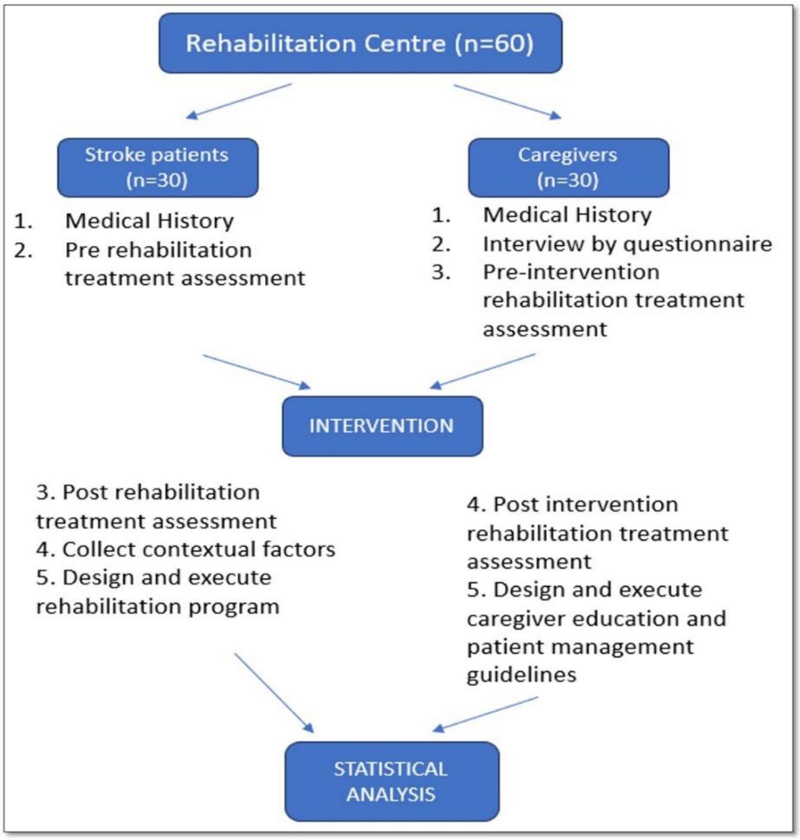

Figure 1: Flowchart of the study

Short Form Health Survey 36 (SF- 36) [15]

The "SF-36" questionnaire is a survey on the patient's state of health, characterized by brevity and precision. It is divided into 36 questions that allow you to assemble 8 different scales and 2 indices that summarize the overall assessments concerning Physical Health (ISF) and Mental Health (ISM). The higher the score, the better the perceived level of health.

Barthel Index [16]

The Barthel Scale or Barthel Index (BI) is a measurement instrument, based on an ordinal scale, commonly used to assess Activities of Daily Living (ADL), i.e. all the fundamental activities that an adult individual performs independently and without the need for assistance to survive and take care of himself. Daily living activities like nutrition, ability to bathe or shower, grooming skills, ability to dress, control of intestinal transit, urination control, use of the toilet, mobility etc. are measured. Each component of ADLs is assessed by deepening the patient's ability to perform independently, with assistance, or dependent on the activity under examination. Depending on the need for help, a score of 0, 5, 10 or 15 points is assigned.

Stroke Impact Scale 3.0 [17],

The stroke impact scale (SIS) is a self-report questionnaire that assesses disability and health-related quality of life after stroke consisting of 59 items, divided into 8 domains like Forza, Hand Function, ADL/IADL, Mobility, Communication, Emotion, Memoria e pensiero and Participation/role function. Each item is rated on a 5-point

Likert scale regarding the difficulty the patient encountered in performing each item. The final score ranges from 0 to 100, adding up each item from each domain.

Modified Rankin Scale (MRS) [18].

The Modified Rankin Scale is used to assess the level of total disability. Its field of use is mainly that of Stroke, both in the acute and post-critical phases. It consists of 6 items, with a score from 0 to 5 (where 0 indicates the absence of disability and 5 the maximum of disability).

2.4.2 The caregiver study consists of collecting caregiver biographical and care history collection, filling a questionnaire on knowledge and skills in disease management, a pre- and post-intervention rehabilitation assessment by administering the Caregiver Burden Inventory rating scale.[19] Caregiver Burden Inventory (CBI) measures five dimensions of burden— time dependence, developmental, physical, social, and emotional burden. It only consists of 24 items and is easily administered in a personal interview or self-administered format. Based on the data, caregiver education and patient management guidelines were designed and administered.

2.5 Caregiver registry and care history collection

The first phase includes a registry collection and the caregiver's care history. A detailed information was collected regarding age and gender, marital status, nationality, employment relationship or degree of connection with the caregiver and the number of work hours or the type of work other than caregiving.

Questions were administered to the caregiver in a second assessment phase, investigating the degree of knowledge of the characteristics of the condition, motor complications that may occur after stroke, and the degree of competence in managing the patient in the home setting. The following is the interview proposed by the physical therapist during the cognitive and informative interview dedicated to the caregiver.

- Has it been explained what stroke is?
- Are you aware of the motor complications that can occur after a stroke?
- Has it been explained what is meant by spasticity?
- Has advice been given on the management and reintegration of the caregiver to be performed in the home environment to provide the best functional recovery and prevent the onset of motor complications?

The rating scale administered during the last stage of data collection to assess the physical and mental caregiver burden borne by the caregiver was Caregiver Burden Inventory [19].

2.6 Collection of contextual factors

The personal contextual factors collected concerning the patient were marital status, household number, degree of education and their employment status. The personal contextual factors collected related to the caregiver were degree of kinship or employment relationship, hours worked, nationality, marital status and degree of education. The environmental factors collected were type of dwelling (condominium / independent villa), presence of architectural barriers and aids possessed in the home.

Rehabilitation protocol:

Following the assessment, a rehabilitation treatment was proposed to the patient to improve their residual abilities and help them reach a higher level of autonomy. The proposed exercises exploit the following concepts:

- Functionality: exercises that aim to achieve a goal or purpose through active participation by the patient relating to the external environment;
- Problem-solving: exercises that stimulate an active process in solving a proposed problem;
- Dual-tasking: activities that aim at the possibility of performing two tasks simultaneously;

The rehabilitation protocol carried out and proposed by the same group of experimenters were Active mobilization, stretching, muscle strengthening, static, gait training, balance, and sensorimotor stimulation. [3,20-23].

2.7 Guidelines intended for the caregiver

An educational phase was dedicated to the caregiver, where the physical therapist explained the main characteristics and complications that characterize stroke in simplified language. The focus was defining the motor complications that characterize stroke in the chronic phase, such as spastic hypertonia. Helpful aids were recommended for the patient's reintegration into post-hospital life and social reintegration. During the sessions, the physical therapist trained the caregiver to manage the prevention of spasticity and pathological radiation by positioning the patient in bed with postures maintained in stretching in the various positions: lateral, supine, prone, and sitting.

Guidance was given to the caregiver in involving the patient in activities of daily living in the home environment, such as dressing and personal hygiene, housekeeping activities or cooking. The caregiver was educated in the performance of aerobic exercise as a daily activity, with the performance of movements such as performing postural transitions, walking around the house or outside the home, climbing and descending stairs, and cardiorespiratory and balance exercises. Finally, leisure activities were proposed to be carried out daily, with the possible adaptations ranging from board games to walking outside the home, running small errands, playful activities and socializing. [24]

2.8 Statistical analysis

Results are reported in terms of frequencies, means and standard deviations. The association between contextual and environmental factors and caregivers' stress levels (CBI score) was assessed by linear regression analysis using the stepwise method. Any significant changes in clinical scales following the proposed interventions were evaluated by paired-sample t-test.

The degree of correlation between increases in clinical rankings and contextual and environmental factors related to caregivers' workloads was assessed by Spearman's bivariate correlation analysis. All analyses were set at a significance level of 95% and power of 80%. Analyses were performed using IBM-SPSS software vers. 27.

3. RESULTS

3.1 Patients

Thirty subjects with stroke were included in the study. Eleven subjects had right hemiplegia, 19 left, by 8.83 ± 9.05 months. Eighteen patients were married, unmarried, or divorced, ten were widowed, and households averaged 3.53 ± 1.22 persons.

Of the patients, 33.3% possessed a high school education, 26.7% were college graduates, 16.7% owned a middle school license, and 23.3% had an elementary school license.

Regarding housing difficulties, 43.3% lived in an easy-to-manage situation (ground floor or presence of elevator), 30% at an average level (presence of stairs in the house), and 26.7% under challenging conditions (absence of elevators in condominium housing). 63.3% needed at least two motor aids, 30% required three aids, and 40% needed only one support.

3.2 Caregivers

Regarding the role of the caregiver, 43.3% were spouses, 40% were caregivers, 13.3% were children, 3.3% were the patient's mother, and 80% were female, aged 52.63 ± 11.44 years.

Nationality was predominantly Italian (73.3%), followed by Romanian (13.3%), Arab (6.7%), Moldavian and Albanian (3.3%). 46.7% of caregivers had at least a high school education, 30% a bachelor's degree, 16.7% an elementary school license, and 6.7% a middle school license. 60% of caregivers reported that they had not been educated about what stroke is or the motor complications following a stroke.

70% said that they had not received helpful advice on the management and reintegration of the caregiver to provide the best functional recovery and prevent the onset of motor complications to be performed in the home environment, and 76.7% reported not knowing what is meant by spasticity.

Stress load (CBI score) at initial assessment was associated with the increased number of aids needed to manage the patient and the degree of caregiver education (Table 1).

Table 1: Variables associated with the caregiver's level of stress

Model			Variables entered	B	t	p
R-square adapted	F	p	(Constant)	39.774	3.682	0.001
0.25	5.836	0.008	N, aids	10.9	3.203	0.003
			Caregiver instruction degree	4.006	2.131	0.042

3.3 Clinical scales

After rehabilitation treatment, a statistically significant increase was found for the SF36, Barthel, SIS, and MRS scales. A significant increase was also found for the CBI scale (Table 2)

Table 2: CBI scale table

	Delta CBI	Delta SF36	Delta BI	Delta SIS	Delta MRS	Caregivers instruction degree	working hours	Home Difficulty	N. aids	Family	
Delta CBI	***r***	1.00	**0.32**	-0.30	-0.11	0.11	0.23	**0.56**	-0.13	0.27	**0.39**
	p	.	**0.04**	0.05	0.29	0.27	0.11	**0.00**	0.24	0.07	**0.02**
Delta SF36	***r***	**0.32**	1.00	**-0.59**	**0.38**	0.27	**0.41**	-0.13	0.16	-0.11	-0.07
	p	**0.04**	.	**0.00**	**0.02**	0.07	**0.01**	0.25	0.20	0.29	0.37
DELTA BI	***r***	-0.30	**-0.59**	1.00	0.04	**-0.43**	-0.21	-0.02	-0.03	0.03	-0.21
	p	0.05	**0.00**	.	0.41	**0.01**	0.13	0.46	0.43	0.43	0.13
Delta SIS	***r***	-0.11	**0.38**	0.04	1.0	0.20	-0.04	-0.12	0.00	0.14	-0.16
	p	0.29	**0.02**	0.41	.	0.14	0.42	0.27	0.50	0.23	0.20
Delta MRS	***r***	0.11	0.27	**-0.43**	0.20	1.00	-0.09	-0.17	-0.06	0.02	0.11
	p	0.27	0.07	**0.01**	0.14	.	0.32	0.19	0.38	0.46	0.29
Caregivers instruction degree	***r***	0.23	**0.41**	-0.21	-0.04	-0.09	1.00	0.03	0.18	-0.28	-0.08
	p	0.11	0.01	0.13	0.42	0.32	.	0.43	0.17	0.07	0.35
working hours	***r***	**0.56**	-0.13	-0.02	-0.12	-0.17	0.03	1.00	-0.26	**0.35**	0.28
	p	**0.00**	0.25	0.46	0.27	0.19	0.43	.	0.08	**0.03**	0.07
Home Difficulty	***r***	-0.13	0.16	-0.03	0.00	-0.06	0.18	-0.26	1.00	**-0.38**	-0.24
	p	0.24	0.20	0.43	0.50	0.38	0.17	0.08	.	**0.02**	0.11
N. aids	***r***	0.27	-0.11	0.03	0.14	0.02	-0.28	**0.35**	**-0.38**	1.00	-0.23
	p	0.07	0.29	0.43	0,23	0.46	0.07	**0.03**	**0.02**	.	0.11
Family	***r***	**0.39**	-0.07	-0.21	- 0.16	0.11	-0.08	0.28	-0.24	-0.23	1.00
	p	**0.02**	0.37	0.13	0.20	0.29	0.35	0.07	0.11	0.11	.

A significant correlation was found between the decrease in CBI scale value and the improvement in patients' SF 36 scores (r=0.32; p = 0.04). The reduction in CBI scale value was also correlated with the caregiver's higher number of working hours (r=0.56; p = 0.00) and larger family composition (r=0.39; p = 0.02). A correlation was also found among the caregiver variables between higher education degrees and increased SF36 scores (Table 3)

Table 3: Correlations between clinical increases and environmental variables.

	Average	SD	T	P	T0-T1 (average)	SD
SF36_T0	86.67	3.74	-9.06	0.00	9.40	5.68
SF36_T1	96.07	5.49				
Barthel_T0	48.50	19.66	-23.39	0.00	38.50	9.02
Barthel_T1	87.00	16.48				
SIS_T0	155.80	30.07	-34.69	0.00	84.53	13.35
SIS_T1	240.33	27.42				
MRS_T0	3.60	0.72	12.45	0.00	1.63	0.72
MRS_T1	1.97	1.07				
CBI_T0	75.73	11.43	19.55	0.00	32.63	9.14
CBI_T1	43.10	11.87				

3.4 Fi-index tool

To avoid any risk of bias about the reference list, this manuscript has been checked with the Fi-index tool and obtained a score of 0 on the date 20/02/24 according to Scopus® for the first author only [25, 26].

4. DISCUSSION

From the analysis of the data collected, it emerged that most caregivers are not educated on the main characteristics of the disease, do not know the motor complications that can occur after stroke and have not been educated or trained to manage the patient within their domicile.

A higher stress level at the initial assessment (CBI t0) documented in caregivers, was related to the more significant number of aids needed for patient management and the caregiver's level of education. It is conceivable that a higher level of education in caregivers, who in our sample possessed relatively high levels of education, could generate a greater expectation of burden on the part of the latter due to a greater awareness of the physical and social problems of the pathology, and concerns about reconciling possible job positions with the needy condition of the family member. However, it is precisely the level of education correlated with the improvement in the patient's quality of life which is associated with decreased stress for the caregiver. The education story helps to understand the educational and management intervention dedicated to the caregiver. The results showed a substantial decrease in caregivers 'stress levels (CBI t1), correlated with a significant improvement in the patient's quality of life after the final evaluation. [27-31]

A comparable study conducted by Bugge C et al. revealed that the duration of care time was a significant factor impacting the mental health of carers, which is similar to the length of care time in the current study, and thus positively correlated with anxiety and depression scores. [32] Another study by Bambauer KZ et al [33] extended periods of care were associated with an increased risk of unpleasant feelings such as depression and anxiety. This could be the result of the carers' lengthy daily care schedules taking up too much of their own time, which lessens their time for work, socialising, and leisure. According to Lv LL et al, Low education levels lead to a lack of understanding about diseases and the capacity to learn about them, which has a negative impact on carers' ability to provide care to some extent and can result in anxiety, depression, and other negative emotional reactions in the caregivers. [34] Our results are also in agreement with Hu P et al who demonstrated that of the caregivers of stroke patients, anxiety symptoms were present in 43.9%, mild to moderate depressive symptoms were present in 26.5%, and severe depressed symptoms were present in 27.4% of cases. Anxiety and sadness were influenced by daily care hours and the way that medical payments were made, and there was a positive correlation between the two conditions and the overall care burden score [35].

Compared to the contextual factors collected, sex and the type of home did not seem to significantly impact the perceived stress level and the patient's functional recovery. The improvement in the caregiver's load is also related to the more significant number of hours dedicated to the assistance and a higher number of members of the patient's family unit. The physical therapist can be the key to contact with the outside world for stroke sufferers who live at home with their caregivers [36-41].

The rehabilitator, assuming a guiding role, can provide directives that give information about what the pathology is, what are its symptoms, what are the recurring problems, and provide practical strategies on patient management and the best reintegration in the home environment, thus ensuring personalized assistance based on the specific needs of the caregivers. Implementing communication with these people to provide helpful information for managing patient care at home can reduce the stress on the caregiver and increase her well-being. Furthermore, the physiotherapist can intervene in the patient by providing a rehabilitation plan that aims to improve the residual abilities of the patient and help him reach a higher level of autonomy. These interventions can significantly reduce the subjective load perceived by the caregiver, which means that relieving the caregiver's stress not only improves the quality of life of the latter but also improves the relationship with the patient and their health [36-38]. The strengths of the study were that as the duration of the study was of a short duration, the participants were compliant. As the study focused on a simple intervention, a bigger sample size can be taken in further studies. The knowledge gained in the intervention was helpful to all, thus, a similar scheme to brush up the knowledge and skills can be taken up by higher education bodies as initiatives.

One of the limitations of this study is represented by the high number of family members in the caregivers and the average high level of education. This sample characteristic may have influenced the correlation analysis. The need to strengthen the family support network of this patient-caregiver dyad and recognize the value of multidisciplinary figures necessary for patient and family care was also noticed. Another limitation of the study is the need to have collected caregivers' daily access diaries. Although the latter declared their hours of assistance, the predominantly family composition of the sample, combined with the fact that the improvements in patients correlated with the number of family members, does not allow us to exclude that some assistance may have also been provided by other relatives of the patients, thus contributing to the reduction of the stress load of the caregivers regardless of the educational intervention administered.

5. CONCLUSION

Caring for a stroke patient is a complex situation that challenges the family caregiver. The results of this study show high levels of uncertainty in patients' family caregivers. In addition, these levels of uncertainty are associated, in a mild but significant way, with the condition of the patient being treated and the symptoms presented by him, the duration of service as a caregiver and the support that the caregiver perceives coming from health, family and society professionals. These findings provide evidence of the importance of the professional physiotherapist in identifying needs and assisting the family caregiver of the stroke patient.

References

1) Vloothuis JD, Mulder M, Nijland RH, Goedhart QS, Konijnenbelt M, Mulder H, Hertogh CM, Van Tulder M, Van Wegen EE, Kwakkel G. Caregiver-mediated exercises with e-health support for early supported discharge after stroke (CARE4STROKE): A randomized controlled trial. PloS one. 2019;14(4):e0214241.

2) Caserta, M.S.; Lund, D.A.; Wright, S.D. Exploring the Caregiver Burden Inventory (CBI): further evidence for a multidimensional view of burden. Int J Aging Hum Dev 1996;43(1):21-34. doi:10.2190/2dkf-292p-a53w-w0a8.

3) Billinger, S.A.; Arena, R.; Bernhardt, J.; Eng, J.J., et al. Physical activity and exercise recommendations for stroke survivors: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014; 45(8):2532-53. doi:10.1161/str.0000000000000022.

4) Knight S. & Tjassing H. Health care moves to the home. World Health No. 4, 1999; 413–444.

5) Corrado OJ. Hospital-at-home. Age Ageing. 2001;30(suppl_3):11-4.

6) Camak, D.J. Addressing the burden of stroke caregivers: a literature review. J Clin Nurs 2015;24: 2376-2382. doi:10.1111/jocn.12884.

7) Santos, N.M.; Tavares, D.M. [Correlation between quality of life and morbidity of the caregivers of elderly stroke patients]. Rev Esc Enferm USP. 2012;46:960-966. doi:10.1590/s0080-62342012000400025.

8) Jenkinson, C.; Wright, L.; Coulter, A. Criterion validity and reliability of the SF-36 in a population sample. Qual Life Res 1994;3:7-12. doi:10.1007/bf00647843.

9) Wepf H, Leu A. Well-being and perceived stress of adolescent young carers: a cross-sectional comparative study. J Child Fam Stud. 2022;31(4):934-48.

10) Jorgensen D, Arksey H, Parsons M, Jacobs S. Caregiver assessment of support need, reaction to care, and assessment of depression. Home Health Care Serv Q. 2009;28(4):130-50.

11) Kudra A, Lees C, Morrell-Scott N. Measuring carer burden in informal carers of patients with long-term conditions. Br J Community nurs. 2017;22(5):230-6.

12) Ohura, T.; Hase, K.; Nakajima, Y.; Nakayama, T. Validity and reliability of a performance evaluation tool based on the modified Barthel Index for stroke patients. BMC Med Res Methodol. 2017;17(1):1-8. doi:10.1186/s12874-017-0409-2.

13) Cook SK, Snellings L, Cohen SA. Socioeconomic and demographic factors modify observed relationship between caregiving intensity and three dimensions of quality of life in informal adult children caregivers. Health Qual Life Outcomes. 2018;16:1-2.

14) Nijboer C, Triemstra M, Tempelaar R, Sanderman R, van den Bos GA. Measuring negative and positive reactions to care for cancer patients: psychometric qualities of the Caregiver Reaction Assessment (CRA). Soc Sci Med. 1999;48(9):1259-69.

15) Ware Jr JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. Med Care. 1992;(6)473-83.

16) Hobart JC, Thompson AJ. The five item Barthel index. J. Neurol, Neurosurg Psychiatry. 2001;71(2):225-30.

17) Lin KC, Fu T, Wu CY, Hsieh YW, Chen CL, Lee PC. Psychometric comparisons of the stroke impact scale 3.0 and stroke-specific quality of life scale. Qual Life Res. 2010;19:435-43.

18) Scale S. Modified Rankin Scale. http://www. strokecenter. org/trials/scales/rankin. html. 2008.

19) Ajmera P, Miraj M, Kalra S, Goyal RK, Chorsiya V, Shaik RA, et al. Impact of telehealth interventions on physiological and psychological outcomes in breast cancer survivors: A meta-analysis of randomised controlled trials. Front Oncol. 2023 Jan 5;12:1017343. doi: 10.3389/fonc.2022.1017343.

20) Banks, J.L.; Marotta, C.A. Outcomes validity and reliability of the modified Rankin scale: implications for stroke clinical trials: a literature review and synthesis. Stroke. 2007;38(3):1091-6. doi:10.1161/01.STR.0000258355.23810.c6.

21) Cappa, S.F.; Benke, T.; Clarke, S.; Rossi, B.; Stemmer, B.; van Heugten, C.M. EFNS guidelines on cognitive rehabilitation: report of an EFNS task force. Eur J Neurol. 2005; 12: 665-680. doi:10.1111/j.1468-1331.2005.01330.x.

22) Fiorillo L, Mehta V, Meto A, D’Amico C. An Analysis of Work-Related Stress Using Smart Devices: A Preliminary Study. *Engineering Proceedings*. 2023;56(1):190. https://doi.org/10.3390/ASEC2023-15956

23) Harvey, R.L.; Macko, R.F.; Stein, J.; Carolee J. Winstein, P.P.T.; Zorowitz, R.D. Stroke Recovery and Rehabilitation; Springer Publishing Company: 2008.

24) Vellone, E.; Savini, S.; Simeone, S.; Barbato, N.; Castrovillano, G.; Caramia, M.D.; Alvaro, R. [Reliability of caregivers in assessing the quality of life of stroke survivors: an explorative study]. Assist Inferm Ric. 2011;30:180-188. doi:10.1702/1007.10956.

25) Fiorillo, L. Fi-Index: A New Method to Evaluate Authors Hirsch-Index Reliability. Publishing Research Quarterly 2022;38(3):465-74. doi:10.1007/s12109-022-09892-3.

26) Fiorillo, L.; Cicciù, M. The Use of Fi-Index Tool to Assess Per-manuscript Self-citations. Publishing Research Quarterly 2022; 38(4):684-92. doi:10.1007/s12109-022-09920-2.

27) Day, C.B.; Bierhals, C.; Santos, N.O.D.; Mocellin, D.; Predebon, M.L.; Dal Pizzol, F.L.F.; Paskulin, L.M.G. Nursing home care educational intervention for family caregivers of older adults post stroke (SHARE): study protocol for a randomised trial. Trials. 2018;19: 96. doi:10.1186/s13063-018-2454-5.

28) Tripathy S, Negi S, Mathur A, Mehta V. Digital Innovations in Pneumonia Care: A Mini Review. Natl J Community Med 2024;15(4):327-331. DOI: 10.55489/njcm.150420243745

29) Mou, H.; Wong, M.S.; Chien, W.T.P. Effectiveness of dyadic psychoeducational intervention for stroke survivors and family caregivers on functional and psychosocial health: A systematic review and meta-analysis. Int J Nurs Stud 2021;120:103969. doi:10.1016/j.ijnurstu.2021.103969.

30) Lutz, B.J.; Young, M.E.; Creasy, K.R.; Martz, C.; Eisenbrandt, L.; Brunny, J.N.; Cook, C. Improving Stroke Caregiver Readiness for Transition From Inpatient Rehabilitation to Home. Gerontologist 2017;57: 880-889. doi:10.1093/geront/gnw135.

31) Lopez, J.; Stacciarini, J.M.; Scarton, L.; Uphold, C.R. Interventions for Informal Caregivers of Stroke Survivors: Is There Racial and Ethnic Representation in Stroke Caregiver Studies? Rehabil Nurs 2022;47:3-11. doi:10.1097/rnj.0000000000000315.

32) Bugge C, Alexander H, Hagen S. Stroke patients’ informal caregivers. Patient, caregiver, and service factors that affect caregiver strain. Stroke. 1999;30:1517–23.

33) Bambauer KZ, Zhang B, Maciejewski PK, et al. Mutuality and specificity of mental disorders in advanced cancer patients and caregivers. Soc Psychiatry Psychiatr Epidemiol. 2006;41:819–24.

34) Lv LL, Guo H, Hu LY, et al. The level and associated factors of caregiving ability of family caregivers of stroke patients. Hu Li Xue Za Zhi 2016;31:1–4.

35) Hu P, Yang Q, Kong L, Hu L, Zeng L. Relationship between the anxiety/depression and care burden of the major caregiver of stroke patients. Medicine. 2018;97(40).

36) McCurley, J.L.; Funes, C.J.; Zale, E.L.; Lin, A.; Jacobo, M.; Jacobs, J.M.; Salgueiro, D.; Tehan, T.; Rosand, J.; Vranceanu, A.M. Preventing Chronic Emotional Distress in Stroke Survivors and Their Informal Caregivers. Neurocrit Care. 2019;30: 581-589. doi:10.1007/s12028-018-0641-6.

37) Moura, A.; Teixeira, F.; Amorim, M.; Henriques, A.; Nogueira, C.; Alves, E. A scoping review on studies about the quality of life of informal caregivers of stroke survivors. Qual Life Res. 2022;31:1013-1032, doi:10.1007/s11136-021-02988-x.

38) Pindus, D.M.; Mullis, R.; Lim, L.; Wellwood, I.; Rundell, A.V.; Abd Aziz, N.A.; Mant, J. Stroke survivors' and informal caregivers' experiences of primary care and community healthcare services - A systematic review and meta-ethnography. PLoS One. 2018;13: e0192533. doi:10.1371/journal.pone.0192533.

39) Cascini F, Gentili A. National Recovery and Resilience Plan and Health: qualitative analysis on the sustainability of the interventions on healthcare. Ann Ig. 2023; 35(5):602-610. doi: 10.7416/ai.2023.2561.

40) Marwan, S.H.; Todo, M. Effects of Hysteresis on the Dynamic Deformation of Artificial Polymeric Heart Valve. Prosthesis 2022; 4:511-523. Doi:https://doi.org/10.3390/prosthesis4040042

41) Sohkhlet G, Thakur K, David SI, Verma P, Jadav V, S J, Palal D, Borah N, Banerjee A, Nallapu S. Stress in Caregivers of Stroke Patients During Rehabilitation: An Observational Study. Cureus. 2023; 15(4):e37410. doi: 10.7759/cureus.37410.